March 12, 2004

Division of Recycling
Market Research Branch

Processing Fee Cost Survey

Final Summary Report

NewPoint Group®
Management Consultants

NewPoint Group®
Management Consultants

March 12, 2004

Mr. Chuck Seidler
Department of Conservation
Division of Recycling
Manager, Market Research Branch
801 K Street, 17th Floor
Sacramento, California 95814

Regarding: **FINAL SUMMARY REPORT,**
PROCESSING FEE COST SURVEY

Dear Mr. Seidler:

On behalf of all the team members who worked on this Processing Fee Cost Survey, NewPoint Group is pleased to submit this Final Summary Report, Processing Fee Cost Survey. The cost survey was performed under contract by NewPoint Group Management Consultants for the California Department of Conservation.

The processing fee cost survey was a major primary–data economic cost survey of California certified recycling centers. This survey was used to estimate California statewide weighted–average, 2002 certified recycler costs per ton, for ten beverage container types. Recycler center costs were surveyed in 2003, using recycler center calendar year 2002 financial statements. Recycler center costs measured by this survey were used for the processing fee calculation, effective January 1, 2004.

This Final Summary Report describes the tasks conducted by NewPoint Group in completing this processing fee cost survey. The Final Summary Report includes a description of the cost survey methodologies, cost per ton calculations and results, and processing fee and processing payment calculations.

The NewPoint Group team appreciates the opportunity to conduct this major economic cost survey for the Department of Conservation. Formulating processing fees is a large cost–accounting challenge, rivaling the technical requirements of state–of–the–art activity–based costing techniques used by private industry.

A project of this magnitude requires a high degree of communication and collaboration by all involved. We wish to thank the Division of Recycling management, and staff in the Market Research Branch, for their tremendous support and cooperation throughout this entire project.

If you have any questions concerning this cost survey, please feel free to contact either myself at (916) 442-0189, or Ms. Wendy Pratt at (916) 442-0508, Extension 6.

Very truly yours,

NewPoint Group, Inc.

James A. Gibson, Ph.D.
Director

cc: Mr. Chris Goetzke
Ms. Zenny Yagen
Mr. Graham Johnson

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Executive Summary

The processing fee cost survey was performed under contract by NewPoint Group Management Consultants, for the California Department of Conservation. This Final Summary Report provides estimates of the cost to recycle aluminum, bi-metal, glass, and plastic (for seven different resin types) beverage containers. This report also summarizes the tasks NewPoint Group, and their subcontractors, conducted in order to obtain the final, statewide, weighted-average, recycler costs per ton.

A. Cost Survey Background

This processing fee cost survey was used to estimate California statewide weighted-average, 2002 certified recycler costs per ton, for ten beverage container material types. Recycler center costs were surveyed in 2003 (April through September), using recycler center calendar year 2002 financial statements. Recycler center costs measured by this survey were used for the processing fee calculation, effective January 1, 2004.

This processing fee cost survey was the largest cost survey undertaken by the Department of Conservation to-date. The NewPoint Group team completed 181 recycler cost surveys to obtain the cost survey results. This processing fee cost survey is also the most detailed and complex of any prior survey, in terms of both quantitative and qualitative information obtained. Finally, this cost survey is the most accurate cost survey yet undertaken.

B. Cost Survey Results

The statewide recycler costs per ton, with and without financial returns, for the ten material types in the beverage container recycling program are presented in **Table E-1**, on the following page. As compared to 1999 costs, for the three materials with equivalent cost per ton calculations, aluminum's cost per ton increased, 18.25 percent, while glass and PET #1 costs per ton decreased, 7.47 and 17.89 percent, respectively. The aluminum and PET #1 trend lines are consistent with what has been experienced historically, with aluminum costs increasing, and PET #1 costs decreasing, as market share shifts from aluminum to PET #1. The glass recycling cost per ton continues to be relatively stable, as it has been over the last several years, at about $80 per ton.

There is no direct comparison for the other seven materials, as this cost survey represents the first time actual statewide recycler costs per ton have been calculated for bi-metal, and plastics #2 to #7. The higher 2002 costs per ton for bi-metal, as compared to aluminum, reflects the lower volume of bi-metal containers recycled, and the inefficiency of handling this minority material. For two of the new plastic resin types, HDPE #2 and Other #7, costs per ton are higher than PET #1, but close to the prior costs of recycling plastics as set by statute for non-PET plastic containers. This statutory plastics number was based on previous PET cost calculations when PET #1 plastics was

a much lower volume container. These two plastic resin types, #2 and #7, are relatively easy to handle, and are recycled in greater quantities than the other new plastic resins. The significantly higher costs per ton to recycle plastic resins #3 to #6 reflect the inefficiency of handling and processing the extremely small volume of these resins.

Table E-1
Statewide Recycler Costs per Ton

	Material	Cost per Ton without Financial Return	Cost per Ton with Financial Return [a]
1	Aluminum	$ 418.95	$ 429.64
2	Glass	79.81	81.85
3	PET #1	479.63	491.87
4	HDPE #2	645.91	662.40
5	Bi-Metal	508.18	521.15
6	PVC #3	1,064.52	1,091.69
7	LDPE #4	3,324.89	3,409.76
8	PP #5	1,478.77	1,516.52
9	PS #6	6,137.30	6,293.96
10	Other #7	759.32	778.70

[a] *The RFR of 2.55% was actually 2.5525464%.*

I. Introduction

This *Final Summary Report*, *Processing Fee Cost Survey*, presents results of a major primary data, economic cost survey of California certified recycling centers (cost survey). The cost survey was used to estimate California statewide weighted-average, 2002 certified recycler costs per ton, for ten beverage container material types. The cost survey was performed under contract by NewPoint Group Management Consultants (NPG), for the California Department of Conservation (DOC), Division of Recycling (DOR).

This report summarizes the methodologies used for the cost survey; presents results of the cost survey calculations; and provides processing fee and processing payment calculations. This introductory section is organized as follows:

A. Cost Survey Background

B. Cost Survey Objectives

C. Cost Survey Tasks.

A. Cost Survey Background

In 1986, the California State Legislature enacted the California Beverage Container Recycling and Litter Reduction Act (AB 2020). This "bottle bill" program is the only one of its kind in the nation in terms of its unique program structure.

A major subprogram within AB 2020 is processing fees on beverage manufacturers, which are paid to recyclers as processing payments to help cover costs of recycling. Processing fees are arguably one of the more complex aspects of AB 2020.

Most recyclers in the AB 2020 program are required to redeem all beverage container material types. Scrap values of glass, plastics, and bi-metal are not sufficient to cover their cost of recycling. These non-aluminum beverage container recycling costs are subsidized by paying recyclers a processing payment. The cost to recycle beverage containers is determined by a processing fee cost survey.

Public Resource Code Section 14575 directs the DOR to calculate processing payments and fees. Processing payments are defined as the difference between the average cost of recycling a beverage container material in the AB 2020 program, including a reasonable financial return, and the scrap value for the material. The processing fee is imposed on beverage manufacturers, and along with supplemental funds from unredeemed containers, these two sources of funds are used to make the processing payments to recyclers.

If an AB 2020 material scrap value is high enough to cover recycling costs, plus a reasonable financial return, no processing fee is imposed. If the scrap value is less than

the average statewide recycling costs, plus a reasonable financial return, then a processing payment is supposed to make up this difference or net cost.

Since their inception, processing fees, and calculated recycler costs, have been controversial. Processing fees have been the subject of numerous studies, task forces, and legislation.

Originally, processing fees were to be automatically equal to the net cost of recycling the subject beverage containers, as measured by studies. Instead, processing fees have fluctuated from year-to-year, depending on legislative, legal, and regulatory policy decisions.

The study approach to calculating the cost of recycling and processing fees has evolved significantly since inception of the AB 2020 program, as the DOR has continually improved recycler costing methodologies. The current labor allocation cost survey methodology was last formally refined in approximately 1995, (*Labor Allocation Cost Model*, in Microsoft *Excel* Template).

Formulating the cost of recycling to determine processing payments and fees is a large cost accounting challenge, rivaling technical requirements of state-of-the-art, activity-based costing techniques used by private industry. The DOR has been innovative in meeting the intent of AB 2020, measuring recycler costs for a system that does not systematically track and measure these costs.

The current processing fee cost survey was initially specified in SB 332 (Statutes of 1999). SB 332 required the DOR to conduct cost surveys every third year (starting in year 2000, for the 2001 processing fees). The 2001 processing fees were the first time, since 1992, that the law required processing fees to be based on actual costs for recycling centers (excluding those receiving handling fees) of receiving, handling, storing, transporting, and maintaining equipment for each container sold using a statistically significant sample of certified recycling centers.

The DOR conducted a processing fee cost survey in year 2000, using 1999 calendar year costs, for the January 1, 2001 processing fees. This was the first of the "every three year" processing fee cost surveys under SB 332.

The subject of this report is the second, "every third year" processing fee cost survey under SB 332. This cost survey, conducted in 2003, using 2002 calendar year recycling costs, was used to determine January 1, 2004, processing fees.

Assembly Bill 28 (Statutes of 2003), effective January 1, 2004, now moves measurement of actual processing fee costs from every three years, to every two years. AB 28 requires the DOC to determine the actual costs for certified recycling centers, on and after January 1, 2004, every second year. The next cost survey after this report will have recycler center costs surveyed in 2005 (using 2004 financial statements), for a processing fee effective January 1, 2006.

B. Cost Survey Objectives

This cost survey was used to estimate costs to recycle aluminum, bi-metal, glass, and plastic (for seven different resin types) beverage containers. Recycler center costs were

surveyed in 2003, using recycler center calendar year 2002 financial statements. Recycler center costs measured by this survey were used for the processing fee calculation, effective January 1, 2004.

The recycler costs per ton presented in this report culminate nine intensive months (February through October, 2003) of research, development, and implementation effort on a primary data economic cost survey of California certified recycling centers. The actual cost survey field work was performed over the six month time period, from April through September, 2003.

Historically, processing fees have been imposed on bi-metal, glass, and PET (# 1 resin type) plastic materials. When additional plastic resin types were incorporated into the AB 2020 program in year 2000, a processing fee was established for six additional (# 2 through #7) plastic resin types, based on the costs of recycling PET plastics. **Table I-1**, following, defines plastic beverage container resin types.

The cost survey in this report is the first time that actual recycling costs have been determined for bi-metal beverage containers, and all the new plastic material type containers added to the AB 2020 program since January 1, 2000 (i.e., plastic resins HDPE (# 2), PVC (# 3), LDPE (# 4), PP (# 5), PS (# 6), and Other (# 7). Under this cost survey recycling costs for the first time have been determined for ten different material types, including three "major" material types (aluminum, glass, and PET #1), and seven "minor" material types (# 2 to #7 plastics, and bi-metal).

Table I-1
Plastic Resin Types

Plastic Resin	Abbreviation
Polyethylene terephthalate	PET #1
High density polyethylene	HDPE #2
Polyvinyl chloride	PVC #3
Low density polyethylene	LDPE #4
Polypropylene	PP #5
Polystyrene	PS #6
Other plastic resins/blended resins	Other #7

Execution of this cost survey required refinements to the DOR legacy labor allocation cost model. More significantly, this cost survey required the development of a new indirect cost allocation sub-model for all plastics and bi-metals. This sub-model is a deterministic outcome model, based on four operational/material handling variables that are both site-specific and sub-material specific (weight factor, container factor, volumetric factor, and commingled factor).

This cost survey is the largest cost survey undertaken by the DOC to-date. The NewPoint Group team completed 181 usable recycler cost surveys to obtain these cost survey results.

This processing fee cost survey is also the most detailed and complex of any prior cost survey, in terms of both quantitative and qualitative information obtained. Finally, this

cost survey is the most accurate cost survey yet undertaken as measured by statistical error rates and confidence intervals.

C. Cost Survey Tasks

Below, we summarize eight key tasks that the NewPoint Group team conducted for the processing fee cost survey.

1. Updated the Labor Allocation Cost Survey Model, a 27-worksheet, *Excel*-based computer model that is used to allocate recycling center costs to beverage container material types based on direct costs and labor allocations. The model was updated to reflect recent legislative, regulatory, and procedural changes to the cost survey. This model was updated before the field survey work was completed.

2. Updated the Cost Survey *Training Manual* (Volume 1). The *Training Manual* (several hundred pages of reference material) consists of 19 modules each with detailed descriptions of cost survey background information, procedures, practice-exercises, and case studies. NewPoint Group also updated two additional supporting volumes (Volumes 2 and 3) to the *Training Manual*. The updates reflect the significant number of legislative, regulatory, and procedural changes that have occurred since the *Training Manual* was first developed in 1995.

3. Developed new cost allocation methodologies, the Indirect Cost Allocation Sub-Models for All Plastics and Aluminum/Bi-Metal, to ensure proper allocation of costs and labor to plastic resins HDPE #2, PVC #3, LDPE #4, PP #5, PS #6, Other #7, and bi-metal (collectively referred to as minority materials). Actual average statewide recycler costs per ton have never been determined for these materials from previous cost surveys. The purpose of the two sub-models, the Indirect Cost Allocation Sub-Model for All Plastics, and the Indirect Cost Allocation Sub-Model for Aluminum/Bi-Metals, is to separate the individual majority and minority material costs from the larger indirect cost categories, all plastics and aluminum/bi-metal. Using operational and material handling factors reflecting extensive field research, the sub-models provide a consistent, site-specific, and sub-material specific, approach for determining costs per ton for both the higher-volume majority materials, and lower-volume minority materials.

4. Conducted a 64-hour training session for the cost survey teams. The training, conducted in the DOR's office conference room, included lectures, background reading, sample exercises, and practical problem-solving. Six DOR staff, and over a dozen NewPoint Group team members, participated in the initial formal training sessions.

5. Scheduled, conducted, and completed 181 recycler site visits during the six months, between April and September 2003, using the statistical sample frame provided by the Division of Recycling. Throughout the scheduling and site visits, the NewPoint Group team developed effective working relationships with the program's recyclers. These relationships were important to the success of this cost survey, and will carry over into future cost surveys. Most of the cost surveys were conducted by a team of two auditors, a Certified Public Accountant (CPA), and a CPA candidate. It typically took between two to four hours to complete the on-site survey. In addition

to the on-site survey, the survey team spent significant time after the site visits to analyze data, and to follow-up with each recycler to obtain complete financial and labor information. A summary of completed sites is shown in **Table I-2**, below.

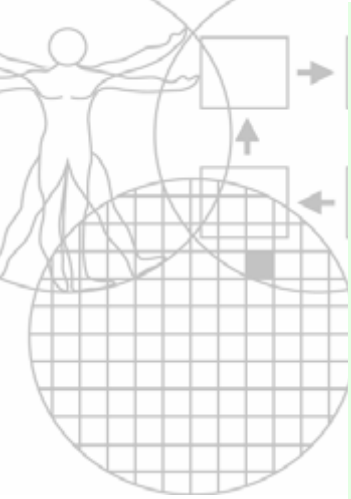
Table I-2
2002 Recycler Completed Sites

Recycler Site Category	Number of Site Visits
Random Sample Sites	136
Non-Random Sample Sites	45
Total	181

6. Developed and implemented an intensive quality control procedure that included over fifteen professional hours, and five different levels of review for each site file. This review took place before the site files were released for processing, and it was followed by two additional quality control steps during the processing of each site file. These quality assurance steps ensured that each site file was complete and accurate, and that all results from the labor allocation model and the indirect cost allocation sub-models were accurate.

7. Entered each site's data into the two sub-models, and compiled the final results in an *Excel* computer workbook as each site file was completed and approved. NewPoint Group calculated total costs by material type, total volumes by material type, and costs per ton, for each of the ten beverage container material types. Calculations used one of three different methods, depending on the material and sample characteristics: (1) weighted statewide average by strata (aluminum, glass, PET #1, and HDPE #2), (2) simple weighted average (bi-metal), or (3) population weighted average (PVC #3, LDPE #4, PP #5, PS #6, and Other #7). Using standard statistical procedures, NewPoint Group calculated error rates at two different confidence intervals for the five relevant material types.

8. Updated the labor allocation cost model for the next generation processing fee cost survey. This model update at the completion of the project integrated and automated the labor allocation cost model with the indirect cost allocation sub-models for all plastics and aluminum/bi-metals. For this processing fee cost survey there had to be a manual crosswalk between these two models. Many additional enhancements were made to this next generation labor allocation cost model so as to provide a new model version to replace the previous legacy model. These additional enhancements were identified with delivery of the new labor allocation cost model.



II. Cost Survey Methodologies

This section describes the cost survey methodologies, from establishing the survey sample frame, to the quality control procedures, and all the supporting tasks in between. There are seven key tasks described in this section:

- *Survey Sample Frame*
- *Survey Scheduling, Logistics, and Confidentiality*
- *Surveyor Training*
- *Cost Model Updates*
- *Methodology for Bi-Metal and Plastics #3 to #7, Indirect Cost Allocation Sub-Models*
- *Cost Survey Procedures*
- *Quality Control and Confidentiality Procedures.*

A. Survey Sample Frame

The Division of Recycling (DOR) developed the survey sample plan. There were two key components to the sample plan, the random sample, and a non-random sample for plastics #3 to #7. Each of these samples is described below. The two sample groups were treated equivalently in scheduling, site visits, and quality control – it was only in the final calculations that a distinction was made between the two sample groups. Surveyors did not know whether a particular site was in the random, or non-random, sample.

Random Sample

The population of recyclers eligible for the cost survey was defined as all recyclers (1) not receiving handling fees, (2) operational at least eight months, during the period November 2001, to October 2002, and (3) certified operational as of March 1, 2002. There were 684 recyclers in the total population.

To increase precision and confidence in the results, while minimizing sample size, the population was divided into three strata, based on glass volume, shown in **Table II-1**.

Table II-1
Stratum Definitions

Stratum	Annual Glass Volume
1	500 tons or more
2	150 to 500 tons
3	150 tons or less

Regulations require that the cost per ton be estimated at an 85 percent confidence level. In addition, the DOR policy is to attain a 10 percent margin of error. To calculate the sample sizes necessary to meet these requirements, the DOR estimated variances using the most recent cost data (collected in 2000 on 1999 costs), and 2002 population data. Because HDPE #2 was not in the program in 1999, the estimated variances for PET #1 were also used for HDPE #2. Using *Excel*'s automated solver, the DOR calculated the

total sample size to attain an 85 percent confidence level with a margin of error less than, or equal to, 10 percent for both glass and PET #1, by allowing the stratum sample size to vary. The actual number of sites surveyed, by material type and stratum, are shown in **Table II-2**, below.

Non-Random Sample

This 2002 processing fee cost survey was the first time that costs per ton for plastic resins #2 to #7 were calculated. HDPE #2, which is reported by most recyclers, was treated like a majority material for sampling purposes, as described above. However, plastic resins #3 to #7 were redeemed at very low volumes, by very few recyclers, and were treated differently for sampling purposes. In the final analysis, there were only 58 recyclers in the eligible population of recyclers that reported any plastic #3 to #7. Thirteen of these sites were already in the random sample.

The DOR determined that the remaining 45 sites with plastics #3 to #7 should all be surveyed, resulting in a census of the full population of plastics #3 to #7 sites. The non-random sample component consisted of the 45 sites that reported some volume of any of the plastics #3 to #7 in 2002, and that were not already in the random sample. Costs per ton for aluminum, glass, PET #1, and HDPE #2 for these sites were calculated, but not included in the statewide cost per ton calculations. However, these sites were included in the cost per ton calculation for bi-metal, as explained in Section III. The actual number of sites (random and non-random) that reported each of the five resin types is shown in **Table II-3**, on the following page.

Table II-2
Actual Random Sample Sizes

Stratum	Aluminum	Glass	PET #1	HDPE #2
1	50	50	50	47
2	47	47	47	46
3	39	34	35	26
TOTAL	136	131	132	119

Table II-3
Number of Recyclers by Resin Type

Resin Type	Number of Recyclers
PVC #3	23
LDPE #4	11
PP #5	11
PS #6	12
Other #7	49

B. Survey Scheduling, Logistics, and Confidentiality

A significant component of the cost survey involved scheduling site visits and the communication interface with recyclers chosen in the sample frame. One staff-person at NewPoint Group was employed full-time during the survey months (April to September) to coordinate scheduling, and communicate with recyclers.

Every NewPoint Group and subcontractor employee that worked on the processing fee cost survey contract signed individual Confidentiality Agreements warranting that they would not disclose any information made available by each certified recycler. Also, each company contractor – NewPoint Group, Inc. (Prime Contractor), Perry-Smith, LLP (Subcontractor), and Leon E. Tuttle, CPA (Disabled Veteran Business Enterprise Subcontractor) - also signed company Confidentiality Agreements.

C. Surveyor Training

There were two components of the survey training process, (1) updating and revising the *Training Manual*, and (2) conducting the 64-hour in-class training program. Successfully completing the processing fee cost survey site visits required knowledge of recycling, recycling practices, the beverage container recycling program, the specific procedures of the site visits, auditing, and financial cost-accounting procedures. The NewPoint Group trained surveyor team consisted primarily of CPAs and CPA candidates. These surveyors had extensive experience in auditing and financial accounting procedures, but little initial knowledge of recycling and the beverage container program. Thus, the 64 hours of classroom training was critical to the success of the cost survey.

Training Manual

The first *Processing Fee Cost Survey Training Participant Manual* was prepared by NewPoint Group in 1995 to support the cost survey training provided to DOR staff at that time. This manual contained hundreds of example case studies, problem sets, quizzes, sample financial documents, handouts, reading assignments, and procedures to develop skills needed to conduct successful processing fee cost surveys.

Because the training manual was originally prepared in 1995, it required extensive revisions and adjustments. Most of the materials in the 1995 manual were dated, and did not reflect statutory, regulatory, and procedural changes in the last seven years. NewPoint Group refined the training modules, prepared new curriculum materials, developed

work assignments needed to support the in-classroom and self-study training modules, and added training modules for new components of the cost survey.

Classroom Training

Classroom training consisted of 64 hours of in-class lectures, reading, exercises, and problem solving. The training was held at the DOR offices, and was conducted over a three-week period, during March 2003. Participants included over one dozen members of the NewPoint Group team, and six members of the DOR staff.

NewPoint Group prepared and presented a PowerPoint slide presentation for each of 19 modules in the Training Manual. About 40 percent of the 64 hours of training was spent in lecture, 20 percent for in-class study, and 40 percent on exercises, problem solving, and discussion. The classroom training was led by experienced NewPoint Group analysts, with support from the DOR project manager.

D. Cost Model Updates

The labor allocation cost model (cost model) is an *Excel* workbook consisting of 27 worksheets. NewPoint Group first developed the model to improve the methodology of the 1995 cost surveys. Since that time it has been updated and revised to accommodate legislative and regulatory changes, as well as upgrades of *Excel*. In 2000, NewPoint Group and the DOC conducted a significant revision to add plastic resins #2 to #7 to the model, and to upgrade to *Excel 1997*, which replaced old *Excel* macros with *Visual Basic* programming. The current version of the cost model represents several legacy generations (and layers) of modifications and updates.

E. Methodology for Bi-Metal and Plastics #2 to #7, Indirect Cost Allocation Sub-Models

As a result of the introduction of new containers to the Beverage Container Recycling Program in 2000, this cost survey was the first time that the cost per ton was calculated for different plastic resins, other than PET #1. The survey, for the first time, introduced cost per ton calculations for six new plastic resin types, #2 to #7. In addition, this cost survey was the first time that actual costs for bi-metal were determined. A key task of this cost survey project was to develop a methodology for plastics #2 to #7.

The overall cost survey used a labor allocation model to allocate costs to each beverage container material type, as well as non-CRV materials, at a given recycling site. The labor allocation approach identified any direct costs that could be attributed to a particular material, or to CRV-only materials, and allocated the CRV-only and remaining site costs based on the percent of total site labor spent on each material type. The total costs for a material type was the sum of the direct costs and the indirect costs, as allocated by the labor allocation model.

This labor allocation approach was proven to be accurate for the three majority material types (aluminum, glass, and PET #1). Previously, the cost per ton for bi-metal was simply assumed to be equal to the cost per ton for aluminum, due to the limited volume of bi-metal, and because at that time, bi-metal was the only minority material in the program. For

this cost survey, bi-metal was one of seven minority material types, and for consistency, bi-metal was treated similarly to the minority plastic resins.

The labor allocation model approach alone was insufficient to determine costs for the seven minority material types (HDPE #2, PVC #3, LDPE #4, PP #5, PS #6, Other #7, and bi-metal). Through extensive field experience it was found that the lowest cost levels realistically measurable through the labor cost allocation model were all plastics, glass, and combined aluminum/bi-metal. Recyclers simply could not determine a percent of total labor per employee for each minority material, which were recycled at significantly lower volumes than the three majority materials. For example, a recycler handling 50 tons of PET #1, 2 tons of HDPE #2, and 0.2 tons of Other #7 in a year could not accurately determine a separate share of labor time for each employee, for each of these three plastic resin types.

There was no precedent, either at the state or national level, for determining the cost per ton to recycle the minority material type beverage containers. In order to determine an approach and methodology for these cost calculations, the NewPoint Group team conducted extensive research and discussions with recyclers and processors in the field. These discussions provided a solid understanding of the challenges and practical issues, including operational and material handling concerns that characterized the recycling of small-volume container types.

The second step in developing the sub-models was to translate the field issues and concerns into a quantitative economic cost model. NewPoint Group identified four basic operational and material handling factors:

- Weight of containers
- Number of containers
- Size (volume) of containers
- Proportion of CRV versus non-CRV containers (commingled rate).

The four operational/material handling factors, along with a weighting allocation across these factors, formed the basis of the indirect cost allocation sub-models for the two majority, and seven minority, materials. To advance from the conceptual model to the quantitative model, NewPoint Group developed equations for each of the four factors, using site-specific and material-specific measurements.

The purpose of the two sub-models, the Indirect Cost Allocation Sub-Model for All Plastics, and the Indirect Cost Allocation Sub-Model for Aluminum/Bi-Metals, was to separate the individual majority and minority material costs from the larger indirect cost categories, all plastics and aluminum/bi-metal. Using operational and material handling factors, the sub-models provide a consistent, site-specific, and sub-material specific approach, for determining the costs per ton for both the high-volume majority materials, and low-volume minority materials.

F. Cost Survey Procedures

There were three phases of an individual cost survey:

- Pre-site visit - data collection and analysis
- On-site visit - cost survey and labor interviews
- Post-site visit - data entry, analysis, and follow-up.

Pre-Site Visit

Before conducting the on-site cost survey, the survey team obtained all available information about that site. Recycling volumes for 2002 were entered into the cost model *Excel* file for each site. In addition, as sites were contacted to schedule site visits, NewPoint Group requested that sites send financial information prior to the site visit. Only 24 out of 181 sites sent financial data ahead of time. When the data was obtained prior to the visit, the survey team entered data into the cost model.

On-Site Visit

Each site visit typically lasted from two to four hours, depending on the size and complexity of the site. The primary data-gathering effort took place during the site visit. Survey teams carefully followed procedures outlined in the *Training Manual*, *Volume 1*. The survey team first toured the site with site management to view and inquire about the site's operations, including materials handled, equipment, recycling procedures, material shipping, etc.

Another key task was reviewing the financial information with site management, or a financial officer, to identify and categorize allowable and non-allowable costs for calculating processing fees, direct and indirect costs, and beverage container indirect (BCI) and all materials indirect (AMI) costs.

The third key task was conducting structured labor allocation interviews to determine allocation of each employee's time first to recycler, processor, or other business, then to direct yard labor or all other labor, and finally by CRV material type or other non-CRV material type. The cost model used this labor allocation information to allocate indirect costs and wages.

Post-Site Visit

After the site visit, the survey team spent from four to ten hours further compiling the data, entering information into the cost model, completing the site memorandum and site file, and reviewing the site file. In many cases, site managers did not have all the necessary information available at the site visit, and the survey team had to telephone to request additional information, or to ask specific questions about the data.

Following the site visit, the team entered the labor information for each employee, as well as the cost summary and direct cost information into the cost model. Once the data was entered into the cost model, the model calculated costs per ton for the three majority material categories. Finally, the survey team compiled and checked all workpapers, and conducted a reasonableness check of survey results before passing the site file on to a second survey team for the first of several independent office review steps.

G. Quality Control and Confidentiality Procedures

Quality control was a primary focus of the cost survey project. Quality control procedures totaled over 15 hours per site, and were essential to ensure that the cost survey results were fair, equitable, accurate, reasonable, justifiable, and defensible.

This extensive quality control process, with seven different individuals or teams, ensured that each site file was complete and accurate. Files that did not meet all the quality control criteria were returned to the original survey team for corrections. Only after this extensive series of quality control reviews was the data used for the final cost per ton calculations, described in Section III.

III. Cost Calculations and Results

This section describes the calculations used, and the final results for, the statewide cost per ton for recycling each of the ten beverage container material types in the California Beverage Container Recycling program. Also, this section includes a comparison of 2002 costs per ton derived from this cost survey with those costs per ton measured in 1999.

A. Cost Calculations

NewPoint Group applied three different approaches to determining the cost per ton for recycling, depending on the material type. The three approaches are described below, and summarized in **Exhibit III-1**, on the following page.

Approach A: Aluminum, Glass, PET #1, and HDPE #2 – most recyclers in the total population accept and recycle these four material types[1]. As a result, for these materials, NewPoint Group used a weighted (by stratum) average statewide cost per ton. There were 136 recyclers in the random sample, divided into three strata. Within each of the three sample strata, the total sample costs and the total sample volumes were determined. The DOR provided the 2002 volume data for the sample and population. The average cost per ton by stratum was calculated by dividing the total cost by the total volume for the stratum. This figure was multiplied by the stratum population volume, to determine the total population costs for each stratum, for each material type. The statewide cost per ton was calculated by summing the three strata total population costs, then dividing by the total population volume. The approach is illustrated in *Exhibit III-1a*.

Approach B: Bi-Metal – bi-metal was recycled by only 113 out of the 684 recyclers in the total population. There were 65 recyclers in the sample (30 random and 35 non-random) that reported bi-metal. The cost per ton for bi-metal was determined by summing the total costs and total volumes for all 65 sites in the sample that reported bi-metal, then dividing the total cost by the total volume from those sites, for a simple weighted cost per ton. The approach is illustrated in *Exhibit III-1b*.

Approach C: Plastics #3 to #7 – only 58 sites out of the 684 recyclers in the total population recycled any of plastics #3 to #7 resins in 2002. As a result, the entire population of recyclers reporting any of the five resin types was surveyed. The cost per ton was calculated by summing the total cost for each resin and dividing by the total volume for each resin, for a simple weighted average cost-per-ton. The approach is illustrated in *Exhibit III-1c*.

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[1] *Somewhat fewer recyclers accept HDPE #2, but the number of recyclers was still quite large, although the volumes were significantly less than for the other three materials, aluminum, glass, and PET #1.*

Exhibit III-1
Cost Calculations

a. Approach A: Aluminum, Glass, PET #1, and HDPE #2

$$\frac{\text{Stratum 1 Sample Costs}}{\text{Stratum 1 Sample Volumes}} \times \text{Stratum 1 Population Volumes} = \text{Stratum 1 Total Population Costs}$$

$$+ \frac{\text{Stratum 2 Sample Costs}}{\text{Stratum 2 Sample Volumes}} \times \text{Stratum 2 Population Volumes} = \text{Stratum 2 Total Population Costs}$$

$$+ \frac{\text{Stratum 3 Sample Costs}}{\text{Stratum 3 Sample Volumes}} \times \text{Stratum 3 Population Volumes} = \text{Stratum 3 Total Population Costs}$$

$$\frac{\text{Stratum 1 Total Population Costs} + \text{Stratum 2 Total Population Costs} + \text{Stratum 3 Total Population Costs}}{\text{Total Population Volumes}} = \text{Statewide Weighted-Average Cost Per Ton}$$

b. Approach B: Bi-Metal

$$\frac{\text{Total Sample Bi-Metal Costs (65 sites)}}{\text{Total Sample Bi-Metal Volume (65 sites)}} = \text{Bi-Metal Sample Cost per Ton}$$

c. Approach C: Plastics #3 to #7

$$\frac{\text{Total Resin Population Costs}}{\text{Total Resin Population Volumes}} = \text{Resin Population Cost per Ton}$$

Financial Return

By statute, recycling costs per ton used to determine the processing fees and payments are to include a reasonable financial return. DOC regulations require that the financial return figure, which is multiplied by the cost per ton, is the "average return on costs for the Scrap and Waste Materials Industry (SIC 5093), as determined from data contained in the most recent Dun and Bradstreet Standard Three Year Norm Report" (California Code of Regulations, S. 2975).

The reasonable financial return (RFR) used for this cost survey was 2.55 percent, based on an average of the most recent three years of data (2002, 2001, and 2000). The RFR has in

general been declining in recent years. For example, the 1999 and 2003 processing fee calculations used RFRs of 5.06 and 2.87 percent, respectively.

B. Cost Results

The costs per ton to recycle for each of the ten material types, with, and without the reasonable financial return, are summarized in **Table III-1**, below. Table III-1 also shows the sample size for each of the ten material types.

Table III-2, on the following page, provides the costs per ton (without financial return) in rank order. The costs per ton fall into six general cost ranges. Glass has the lowest costs, less than $100 per ton. Aluminum, bi-metal, and PET #1 costs are in the next range, in the $400 to $500 per ton range. HDPE #2 and Other #7 are in the next cost range, in the $600 to $700 per ton category. PVC #3 and PP #5 are in the next cost range, in the $1,000 to $1,500 per ton area. LDPE #4 is next, in the $3,000 per ton cost range. Finally, PS #6 is in the highest cost group by far, with costs per ton in the $6,000 range.

Table III-1
Statewide 2002 Costs per Ton to Recycle

	Material	Cost per Ton without Financial Return	Cost per Ton with Financial Return [a]	N = Sample Number of Sites [b]
1	Aluminum	$ 418.95	$ 429.64	136
2	Glass	79.81	81.85	131
3	PET #1	479.63	491.87	132
4	HDPE #2	645.91	662.40	119
5	Bi-Metal	508.18	521.15	65
6	PVC #3	1,064.52	1,091.69	23
7	LDPE #4	3,324.89	3,409.76	11
8	PP #5	1,478.77	1,516.52	11
9	PS #6	6,137.30	6,293.96	12
10	Other #7	759.32	778.70	49

[a] *The RFR of 2.55% was actually 2.5525464%.*

[b] *Overall, 181 sites were completed to obtain these results.*

Error Rates and Confidence Intervals for Costs per Ton

The California Beverage Container Recycling and Litter Reduction Act, Section 14575, requires the DOC to conduct "a survey of a statistically significant sample of certified recycling centers, excluding those receiving a handling fee". In the California Code of Regulations, a "statistical sample" is defined as an estimate with an 85 percent confidence level (S.2000 (a) (47)). Internal DOC policy further establishes a 10 percent error rate. The sample size required to meet the 85 percent confidence level was determined using pro forma data from the 1999 year cost survey results. Only after the survey was complete could it be determined whether the actual requirement of an 85 percent confidence interval, and the target of a 10 percent error rate, were met.

Table III-2
Statewide 2002 Costs per Ton in Rank Order

	Material	Cost per Ton without Financial Return
1	Glass	$ 79.81
2	Aluminum	418.95
3	PET #1	479.63
4	Bi-Metal	508.18
5	HDPE #2	645.91
6	Other #7	759.32
7	PVC #3	1,064.52
8	PP #5	1,478.77
9	LDPE #4	3,324.89
10	PS #6	6,137.30

The analysis of the final data shows that the processing fee cost survey met and exceeded all the statistical requirements. In all cases the error rate at the 85 percent confidence level was below 10 percent. Table III-3 on the following page provides the error rate at the 85 percent confidence interval for each of the five relevant materials.

To determine whether the results met a higher statistical standard, NewPoint Group also calculated error rates at the 90 percent confidence level. As shown in Table III-3, the error rate for each material is also less than 10 percent at the 90 percent confidence level, as well.

It was a significant accomplishment to achieve the error rate goals in this cost survey. There are two reasons for achieving these error rate goals. The first reason is a significantly increased sample size, with 136 sites for 2002, in the random sample. The second reason is that as in past surveys the NewPoint Group methodology included extensive site file oversight and quality control review. Seven levels of review were conducted for each site, and many site files were sent back to the original survey team for additional investigation, and often times revisions, before they were finally approved.

Table III-3
2002 Error Rates

Material Type	2002 Error Rate at 85% CI	2002 Error Rate at 90% CI
Aluminum	6.85%	7.82%
Glass	8.06	9.21
PET #1	8.55	9.77
HDPE #2	8.56	9.78
Bi-Metal	6.63	7.57

C. Comparison of Cost Results

The statewide recycler costs per ton for the ten material types in the beverage container recycling program are presented in **Table III-4**, on the following page. The costs per ton are shown by order of magnitude, from lowest to highest costs.

The 2002 costs per ton are compared to 1999 costs per ton, the last time recycler costs were actually measured by the Department of Conservation. As compared to 1999 costs, for the three materials with equivalent cost per ton calculations, aluminum costs per ton increased, 18.25 percent, while glass and PET #1 costs per ton decreased, 7.47 and 17.89 percent, respectively.

These recycling cost per ton results are consistent with historical trends of aluminum costs per ton increasing, and PET #1 cost per ton decreasing, as market share shifts from aluminum to PET #1 container materials. The recycling cost per ton for glass containers continues to be relatively stable, as it has been for the last several years.

Between 1999 and 2002, the number of PET #1 CRV containers recycled more than doubled. This has a large effect on lowering the PET #1 cost per ton. In general, the cost per ton to recycle PET #1 has secularly decreased over the past fifteen years.

There is no direct cost comparison for the other seven materials, as this cost survey represents the first time actual statewide recycler costs per ton have been calculated for bi-metal, and plastics #3 to #7. The higher 2002 costs per ton for bi-metal, as compared to aluminum, reflects the lower value of bi-metal containers recycled, and the inefficiency of handling this minority material.

Table III-4
Comparison of Statewide Costs per Ton

Material Type	2002 Statewide Costs per Ton	1999 Statewide Costs per Ton	Three-Year Percentage Change
Glass	$ 79.81	$ 86.25	-7.47 %
Aluminum	418.95	354.30	+18.25 %
PET #1	479.63	584.14	-17.89 %
Bi-Metal	508.18	Same as aluminum	
HDPE #2	645.91	Set by statute at $642.69	
Other #7	759.32		
PVC #3	1,064.52		
PP #5	1,478.77		
LDPE #4	3,324.89		
PS #6	6,137.30		

For two of the new plastic resin types, HDPE #2 and Other #7, costs per ton are higher than PET #1, but close to the prior costs of recycling plastics as set by statute for non-PET plastic containers. This statutory plastics number was based on previous PET cost calculations when PET #1 plastics was a much lower volume container. These two plastic resin types #2 and #7, are relatively easy to handle, and are recycled in greater quantities than the other new plastic resins. The significantly higher costs per ton to recycle plastic resins #3 to #6 primarily reflect the inefficiency of handling and processing the extremely small volume of these resins.

IV. Processing Payment and Fee Calculations

Public Resource Code Section 14575 directs the DOR to calculate processing fees and processing payments. Processing payments are equal to the difference between the average statewide cost of recycling a beverage container material in the AB 2020 program, including a reasonable financial return, and the scrap value for the material. The processing payment equation is defined as follows:

Processing Payment = (Cost to recycle + Reasonable Financial Return) – (Scrap Value)

If the AB 2020 material scrap value is high enough to cover recycling costs, plus a reasonable financial return, no processing payment is needed. If the scrap value is less than the average statewide recycling costs, plus a reasonable financial return, then the processing payment is supposed to make up this difference.

The processing payment is to be based on the actual costs for recycling centers (excluding those receiving handling fees) of receiving, handling, storing, transporting, and maintaining equipment for each container sold using a statistically significant sample of certified recycling centers.

The processing fee is imposed on beverage manufacturers, and along with supplemental funds from unredeemed containers, these two sources of funds are used to make the processing payments to recyclers. Processing fees are assessed on each container sold to beverage manufacturers.

Because unredeemed DOR funds are used to supplement the processing fee, the processing fees on beverage manufacturers are less, on a per container basis, than the processing payments to recyclers. The actual amount of the processing fee is based on the recycling rate of the container type, as specified in AB 28, signed into law in October 2003. These beverage container manufacturer off-sets under AB 28 for the January 1, 2004, processing fees are as follows:

- 88 percent – Glass and PET #1
- 80 percent – HDPE #2
- 35 percent – Bi-metal and Plastics #3 to #7

Processing fees effective January 1, 2004 are based on calendar year 2002 costs (measured in 2003), containers per pound rates effective January 1, 2004, and the statewide average scrap values from October 2002 to September 2003. Scrap values are discussed below.

A. Scrap Values

The scrap value survey was performed by a separate DOR monthly census of all processors. Processing payment determinations were based on scrap values paid to recyclers between October 1, 2002, and September 30, 2003. **Table IV-1**, below, shows DOR calculated scrap values per ton for this processing fee calculation as compared to scrap values used in the prior year.

In the last year, some material type scrap values have declined, and some have risen. Most notably, PET #1 plastic scrap values have risen over 84 percent in the last year. Also, bi-metal scrap values have increased over 705 percent.

Table IV-1
Scrap Values Per Ton

Material Type	Percentage Change 2002 to 2003	October 2002 to September 2003	October 2001 to September 2002
Aluminum	+7.82%	$997.14	$924.81
Bi-Metal	+705.56%	1.45	0.18
Glass	–23.49%	7.33	9.58
PET #1	+84.46%	161.46	87.53
HDPE #2	+15.96%	151.78	130.89
PVC #3	–17.60%	12.64	15.34
LDPE #4	N/A	14.00	0.00
PP #5	N/A	0.00	0.00
PS #6	N/A	0.54	0.00
Other #7	–30.11%	7.87	11.26

B. Processing Fees

Table IV-2, below, presents 2004 processing payments to recyclers, effective January 1, 2004. Table IV-2 also presents the processing fee paid by beverage manufacturers after reflecting the beverage container manufacturer off-sets.

Table IV-2
2004 Processing Fees, Effective January 1, 2004

Material Type	Cost of Recycling with Reasonable Financial Return *(Per Ton)*	Scrap Value *(Per Ton)*	Processing Payments to Recyclers *(Per Ton Redeemed)*	Processing Payments to Recyclers *(Per Container Redeemed)*	Processing Fees Paid by Beverage Manufacturers *(Per Container)*
Bi-Metal	$521.15	$1.45	$519.70	3.375¢	2.194¢
Glass	81.85	7.33	74.52	1.993	0.239[a]
PET #1	491.87	161.46	330.41	1.338	0.167
HDPE #2	662.40	151.78	510.62	5.210	1.042
PVC #3	1,091.69	12.64	1,079.05	5.505	3.578
LDPE #4	3,409.76	14.00	3,395.76	4.851	3.153
PP #5	1,516.52	0.00	1,516.52	11.489	7.468
PS #6	6,293.96	0.54	6,293.42	4.508	2.930
Other #7	778.70	7.87	770.83	3.323	2.160

[a] *Glass processing fee paid by beverage manufacturers is reduced to 0.181¢ per container per Section 14575(k) of the Public Resources Code (amended by AB 28).*